Research Proposal of the Thesis Entitled

To compare the adjunctive effects of the diode laser in open flap debridement to mechanical debridement using clinical and microbiological criteria - In vivo research

Submitted for the Award of the Degree Of

Doctor of Philosophy

In

Dentistry

(Periodontology)

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INTRODUCTION

Chronic inflammatory periodontitis endangers dental support and may result in tooth loss. Plaque biofilm and bacteria-induced inflammation are the fundamental causes of this illness, which destroys periodontal tissues. Periodontitis, the leading cause of losing teeth in adults, requires rapid and effective treatment. Using periodontal diagnostics, clinicians are able to detect the type of illness, its location, and the severity of the condition. Probing depths, bleeding on probing, clinical attachment levels, plaque index, and alveolar bone radiographs are some of the diagnostic markers that are utilized in clinical settings concerning periodontal disease. (Armitage, 2004) Microorganisms are the primary etiologic factor of periodontal disease (Socransky, 1977). Loe and coworkers have demonstrated that rigorous plaque control procedures (Löe et al., 1965) or antiseptic agents (Loe & Rindom Schiott, 1970) are able to prevent or reverse clinical gingivitis in human volunteers. Selective organisms may contribute to periodontal disease, as only specific bacterial colonies present in bacterial plaque are susceptible to a particular antibiotic.

The intent of any periodontal therapy is to eradicate the microorganisms that are responsible for the development of periodontal disease. This is accomplished through the utilization of mechanical debridement, which includes thorough deep scaling with the utilization of manual instrumentation and/or power-driven instrumentation, in conjunction good oral hygiene. In order to restore the periodontal health and function, non-surgical periodontal therapies such as scaling and root planing are performed, and then periodontal surgical operations are performed. (Carlsson, 1983).

A significant amount of progress has been made in the field of periodontics as a result of recent developments such as lasers, microsurgery, and other therapy tools. The use of laser technology, more especially the diode laser, is becoming increasingly common in general dental practice because to the potential advantages it offers in a wide variety of practice settings.(Gokhale et al., 2012). The use of lasers has made it possible for us to have a Possible alternative that could effectively eliminate diseased soft tissues, specifically target bacteria, and promote wound healing simultaneously.

Lasers use optical amplification to emit light (electromagnetic radiation). Different laser systems and wavelengths have been utilized to treat periodontal disease. Due to the fact that it is cost-effective, portable, and easy to operate, the diode laser widely used choice of advance

laser invention. Major pathogens of periodontitis have been discovered. Disease requires bacteria but not only them Subgingival microbial plaque is a biofilm Costerton et al.(Costerton et al., 1994)

Subgingival microbial plaque strongly attaches to tooth roots and exhibits biofilm features. Contrary to other biofilms, there are bacteria that are not firmly adhered and can be found between the biofilm and the gingival tissue. A notable breakthrough in the field of periodontal microbiology in recent times is the identification of subgingival microbial plaque as a biofilm, along with the rapid expansion of understanding about biofilms.

This research intends to look at the additional benefits as for using a diode laser conjugated with open flap debridement surgery in comparison to standard mechanical debridement. The evaluation will be based on clinical and microbiological criteria in an in vivo research paradigm.

STATEMENT OF PROBLEM

It has been observed that continued loss of periodontal structure leads to loss of healthy tooth.

CLINICAL IMPLICATION OF THE STUDY

There are many clinical studies suggesting limited approach of surgical therapy, use of laser has definitely and will add to great handling of the tissue and greater penetration leading to destructions of microorganisms which were left untreated in case of surgical approach.

AIM

This research aims to investigate, by clinical and microbiological criteria in vivo research, the adjunctive effects of the diode laser in open flap debridement as compared with the standard mechanical debridement.

OBJECTIVES

- To compare and evaluate the efficacy of 980 nm wavelength diode laser as an adjunct to conventional flap surgery in treatment of chronic periodontitis patients.
- The intensity of pain experienced by the patient during the treatment and 1 week postoperatively will be analyse with the help of a VAS (Visual Analogue Scale).
- To evaluate and compare the microbial count at pre and post treatment stages.

HYPOTHESIS

Proposed Hypothesis

The merits of lasers in field of periodontal diseases will be more beneficial as compared to surgical therapy with the advantage of better penetration in the tissue layers and less tissue damage leading to good periodontal repair.

Null Hypothesis

Through the null hypothesis this research will proceed on the hypothesis that there is no difference between the effectiveness of a diode laser intensity of 980 nm as a supplementary treatment to flap surgery in participants with chronic periodontitis was assessed. The study found no statistically significant difference in the bacteria count before and after the treatment.

Review of Literature

Snitzer E et al.,1961[13] introduced a room-temperature glass optical maser with trivalent neodymium as the active ion. The device generates precise lines within a wavelength range of 30 angstroms, with a central wavelength of 1.06 microns. The nominal index of refraction is 1.54 and the glass's density is 3. The values of Nd+'s term values closely resemble those of a crystal or free ion due to the excellent insulation provided by the 4f' electron configuration. Examining the spectrum of NdCl2 provides insight on the diagram of energy levels. At a wavelength of 880 nm, there is an absorption caused by the transition from the very low basic state (I~) upto fluorescence-emitting level (+z). The most prominent absorption line in the visible and near-infrared spectrum has a wavelength of 580 megapascals (MP). The broad lines, which have a width of several hundred angstroms, originate from the terminal states of spontaneous emission at wavelengths of 0.88, 1.06, and 1.3 p. The radiative decay from the 4I"» state has a lifespan of 0.6 msec, as determined from absorption and fluorescence spectra. High quantum efficiency for fluorescence is seen by the 0.56 e lifetime. (Snitzer, 1961)

Löe H et al., 1965[14] examined periodontal disease genesis and maintenance. Oral detritus and periodontal damage is linked. Microscopy and electron microscopy show that deposit microorganisms and gingival tissues are intimately related. Clinical studies suggest debris collection causes gingival irritation. Other studies have confirmed that gingival inflammation decreases once bacterial deposits are eliminated. Biochemical and micro biological studies

suggests that periodontal disease is caused by bacterial activity and host tissue, and provides some explanation. Finally, bacteriological research has shown that the difference between healthy and inflamed gingivae's microbial flora is mostly quantitative, with modest compositional variations. They evaluated gingivitis in people with healthy gingivae by removing all oral hygiene efforts and studying the sequence of changes in the microbial flora and gingivae. (Löe et al., 1965)

Loe H et al., in their study conducted in 1970[15], provided confirmation that using two daily mouth rinses containing 0.2% chlorhexidine is highly beneficial in preventing the formation of plaque. Once in day rinse did not prevent plaque in all dental regions. A 2% chlorhexidine gluconate topical spray inhibited plaque development totally every day. After stopping chlorhexidine, plaque formed at usual rates, demonstrating little effect beyond a daily period. If chlorhexidine is applied regularly to all tooth surfaces, it can completely suppress plaque and prevent gingivitis. (Löe & Rindom Schiøtt, 1970)

Stern RH et al., 1972[16] found that lashing enamel was more resistant to oral environmental variables that promote dental cavities in one of the participants. The data provided here are the first in vivo evidence that a physical energy source may aid preventive dentistry. We should investigate this physical approach not just for its direct potential but also as an energy source to boost chemical reactions and bonding of topically applied drugs and compounds. (Stern & Sognnaes, 1972)

Hale GM et al. (1973)[17] measured water extinction coefficients k(lambda) at 25°C. The k(lambda) versus wavelength lambda graph was smoothed manually by examining water optical constants data, allowing for determination of its behaviour over a large spectrum of frequencies. Where in vacuum UV and soft x-ray data were unavailable, k(lambda) absorption bands were theorized. The authors calculated the index of refraction n(lambda) for the spectral area 200 nm </= lambda </= 200 micro-meter using a subtractive Kramers-Kronig analysis of the combined hypothesized and smoothed portions of the k(lambda)(Hale & Querry, 1973)

Listgarten MA et al., 1975[18] demonstrated that early plaque is mostly coccal and becomes filamentous by 3 weeks. Early plaque growth appears to involve columnar microcolonies that consolidate and divide perpendicular to the crown surface. By week 1, filamentous

microorganisms are abundant. They grow into the primarily coccal plaque and replace the coccal forms. Many motile bacteria with unique cell wall ultrastructure live in mature subgingival plaque. Some bacteria form "corn cobs" and "test tube brushes," they are exclusively found in subgingival plaque. Spirochetes exhibit a preference for growth on subgingival plaque near the deeper sulcus' gingival tissue. Their considerable concentration in the exterior layer of subgingival plaque shows that their strategic location may contribute to periodontal disease. (Listgarten et al.,1975)

Lindhe J et al., 1975[19] investigated the concept that microbial plaque causes periodontal disease and that individuals willing to control plaque can cure even advanced periodontitis. Materials included 75 patients with significant periodontal tissue loss. The patients were chosen for the trial because they had plaque-free teeth. A tentative treatment plan was offered to patients after an initial exam. Comprehensive guidelines were given for managing plaque, doing scaling and root planing, handling dental emergencies, conducting endodontic therapy, and carrying out extractions. Pathologically deepened pockets were surgically removed three to six months after presurgical therapy. Patients were revisited every 3–6 months after treatment. The re-examinations assessed the “gingival index, plaque index, pocket depths, marginal alveolar bone morphology, pocket depths and height”. The results show that patients willing to maintain plaque-free teeth can treat advanced periodontal disease. (Lindhe & Nyman, 1975)

Listgarten MA et al., 1976[20] identified isolated filamentous or branching bacteria. No flagellate cells or spirochaetal species were detected. The samples of gingivitis exhibited a greater variety of microorganisms located above the gum line, including an increased presence of filamentous bacteria and Gram-negative cells. These samples also included surface-of-- the teeth corncobs and cells with flagellum with spirochetes in the gum pocket's bottom, which is populated by Gram-negative bacteria. The supragingival bacterial deposits of periodontitis samples resembled gingivitis. Generally, a transitory flora separated supra- and subgingival microbes. Mostly Gram-negative bacteria dominated periodontosis samples. Most samples had a peculiar electrondense, lobulated cuticular deposit. Post periodontosis samples had a more similar microbial ecology to periodontitis. The results suggest that a certain microbial flora may be compatible with periodontal health; a different flora is associated with varying degrees of periodontal disease; the supragingival flora differs

markedly from the subgingival flora; and with the exception of periodontitis, the microbial flora changes as periodontal disease worsens. (Listgarten, 1976)

Rosling B et al., 1976[21] examined the theory that periodontitis can be treated and that infra-bony pockets regenerate bone in ideal oral hygiene patients. The sample consisted of twenty-four participants with advanced periodontitis. Following a basic check-up, patients were randomized to test and control groups in a random manner. After learning proper dental hygiene, all patients had modified Widman flap periodontal surgery. After treatment, test group participants were reviewed at duration of two weeks is required for a professional teeth cleaning for two years. Prophylactic recalls of control patients occurred annually. All test patients' osseous abnormalities were filled with bone. However, the control patients had poor dental hygiene and increasing periodontal tissue deterioration during postsurgical surveillance. (Rosling, Nyman, & Lindhe, 1976)

Page RC et al., 1976[22] explained chronic periodontitis. It is a prevalent microbiological illness that causes most adult tooth loss. Many chronic inflammatory characteristics can be studied using the disease as a model. The initial lesion, a characteristic acute exudative vasculitis, occurs within 2–4 days of microbial plaque deposition in the gingival tissues. This reaction, which includes collagen loss such as perivascular, which is similar to that of most other tissues injured acutely and may be caused by microbial plaque releasing chemotactic and antigenic chemicals. Early lesions form in 4–10 days. It is marked by a strong lymphocyte and mononuclear cell infiltrate, pathologic fibroblast change, and connective tissue loss. The structural aspects of the early lesion are compatible with cellular hypersensitivity, which may be a pathogenic process. The established lesion is primarily composed of plasma cells and typically develops within a period of 2-3 weeks, with minimal bone loss. The scientists stated that the broad lesion in humans and animals may remain stable for years or decades or evolve into a destructive lesion. (Page & Schroeder,1976)

METHODOLOGY

Study Design and Area

After approval from the ethical committee, data was collected from the patients who came to the Department of Periodontology, Karnavati School of Dentistry according to inclusion and exclusion criteria. Using a stent, the baseline clinical parameters of the test and control groups were noted; the subjects were split into two groups—each with twenty individuals. It

was a prospective split mouth study in which twenty patients were selected, who were diagnosed with chronic generalized periodontitis and meet the inclusion and exclusion criteria of the study protocol.

Measures

I. Plaque index (PI) (Silness and Loe)

II. Gingival index (GI) (Loe and Silness)

III. Probing depth (PD) (Using an acrylic stents)

IV. Relative clinical attachment level (CAL) (Using an acrylic stents)

The clinical parameters were recorded with the help of a UNC-15 probe at the baseline and 3 months post operatively.

Visual Analogue Scale (Vas)

The patient's pain severity during the therapy and one week after the operation was assessed using a Visual Analog Scale (VAS).

Microbial Analysis:

Samples of subgingival plaque were taken from participants in each group at the beginning of the study, one month after surgery, and three months after surgery. These samples were collected in Robertson cooked beef media, which is a transport medium. The samples were then sent for measurement of anerboic bacterial counts within one hour of collection.

Inclusion Criteria:

• After phase I therapy, patients aged 30-50 with persistent periodontitis and probing not on the same tooth.

• Patients having at least 6 teeth in the quadrant of either maxilla or mandible with bilateral periodontal pockets will be considered for this split-mouth trial.

• Patients without periodontal therapy in the last 6 months.

Exclusion Criteria:

• Participants who are diabetic, pregnant women, or nursing moms, as well as smokers, will not be allowed to participate in the study.

• Patients who have a history of receiving antibiotics three months prior to their initial visit will not be allowed to participate in the trial.

• Patients who have bone architecture and will require regenerative or respective operations are not included in this study. Their participation is not permitted.
• Those patients who have tooth movement of Grade III

Surgical Procedure

Each patient who arrived at the outpatient facility of the department underwent examination and assessment to ascertain their eligibility for the study. Furthermore, each patient was required to provide a signed consent form, which included details about the treatment and the study. Random allocation of the study participants to one of two groups in order to facilitate their participation. Patients who were assigned to group 1 for the purpose of serving as a control group had conventional flap surgery. Following the administration of local anesthetic (2% lignocaine in a ratio of 1:80,000) to the patients who were assigned to this group, intrasulcular incision given by using a 15 no. BP blade. This was done after the patients had achieved the desired level of anesthesia. The mucoperiosteal flap was lifted to its full thickness, and root debridement and curettage were performed with the use of Gracey curettes that were specifically designed for the area. No chemical agents were used. Next, 3-0 silk sutures were used to stitch the flap back together. A periodontal pack was applied to the surgery site in order to inhibit infection. Under local anesthetic, patients in group 2 underwent laser treatment at a intensity of 940 nm alongside open flap debridement treatment. Following flap alignment, a 940 nm diode laser with 2.5 W power output a continuous wave was used to irradiate the inner surface of the flap in contact mode for a period of ten seconds.

Using damp gauze, the burned layer was removed from the surface. In order to reach the apical part of the flap, the tip was intended to be pointed. A standard saline solution was used to irrigate the area. It was with the assistance of an ultrasonic scaler that the subgingival calculus was eliminated. Bone and root surfaces that were exposed to radiation were not covered by the radiation. Next, 3-0 silk sutures were taken to close the periodontal flap back together. The surgical site was wrapped with periodontal pack toprevent infection. Regularly scheduled measurements of clinical and microbiological data were collected and recorded periodically. For the purpose of microbiological analysis, samples were taken from the deepest pockets. “At the onset of the trial, samples were collected at time T0 (before to scaling and root planning), time T1 (two weeks after scaling), and time T2 (three months following surgery)”.

Data analysis

Data will be examined using SPSS software.

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